GLOSSARY

ROS 2 : Robot Operating System 2, provides libraries, tools, and communication infrastructure to help developers create robot applications.

RTOS : Real-Time Operating System, an operating system designed for real-time applications that require precise timing and responsiveness.

GPIO : General Purpose Input/Output, a set of pins on a microcontroller or single-board computer that can be configured as either inputs or outputs.

ESC : Electronic Speed Controller, a device used to control the speed and direction of electric motors in various applications.

ROI : Region Of Interest, a specific area or region within an image or video frame that is selected for further analysis and processing.

PWM : Pulse Width Modulation, a technique used to encode information in a pulsing signal by varying the width (duration) of the pulses while keeping the frequency constant.

NiMH : Nickel-Metal Hydrate, a type of rechargeable battery chemistry that uses a nickel hydroxide cathode, a hydrogen-absorbing alloy anode, and an alkaline electrolyte.

LiDAR : Light Distance and Ranging, a remote sensing technology that uses laser pulses to measure distances and create detailed three-dimensional (3D) maps or point clouds of the surrounding environment.

GPS : Global Positioning System, a satellite-based navigation system that provides location and timing information anywhere on earth.

RC : Radio Controlled, a technology that enables the remote operation and control of devices using radio frequency signals.

HMP : Heterogeneous Multi-Processing, a computing system or architecture that combines multiple different types of processing units or cores to optimize performance and power efficiency.

REFERENCES

O'Kelly, M. *et al.* (2020) *F1tenth: An open-source evaluation environment for continuous control and reinforcement learning, PMLR*. Available at: https://proceedings.mlr.press/v123/o-kelly20a.html.

f1tenth.org. (n.d.). Learn. [online] Available at: https://f1tenth.org/learn.html.

Maruyama, Y., Kato, S. and Azumi, T. (2016). Exploring the performance of ROS2. *Proceedings of the 13th International Conference on Embedded Software - EMSOFT '16*. Available at: https://doi.org/10.1145/2968478.2968502.

design.ros2.org. (n.d.). *Changes between ROS 1 and ROS 2*. [online] Available at: http://design.ros2.org/articles/changes.html#:~:text=ROS%201%20uses%20a%20custom.

Mazzari, V. (2019). ROS vs ROS2. [online] Génération Robots - Blog. Available at: https://www.generationrobots.com/blog/en/ros-vs-ros2/.

docs.ros.org. (n.d.). ROS 2 Documentation — ROS 2 Documentation: Humble documentation. [online] Available at: https://docs.ros.org/en/humble/index.html (Accessed: 2023).

Zakaria, N.J., Shapiai, M.I., Ghani, R.A., Yassin, M.N.M., Ibrahim, M.Z. and Wahid, N. (2023). Lane Detection in Autonomous Vehicles: A Systematic Review. IEEE Access, [online]11, pp.3729–3765. Available at: https://doi.org/10.1109/ACCESS.2023.3234442.

micro-ROS. (n.d.). micro-ROS. [online] Available at: https://micro.ros.org/.

Tuteja, S. (2022). Connect ESP32 to ROS2 Foxy. [online] Medium. Available at: https://medium.com/@SameerT009/connect-esp32-to-ros2-foxy-5f06e0cc64df.

Ariesta, K. (2017). *Implementation Of Lane Tracking System With Vision On Autonomous Racing Car Using Robot Operating System,* Swiss German University.

APPENDIX A - DATASHEETS

1. PS3 Eye Camera

Interface
USB 2.0

Connector
USB

Power consumption
DC5V, Max. 500mA

Dimension (approx.)
84 x 67 x 57mm

Weight (approx.)
173g

Cable length (approx.)
2 metres

Operation temperature
5°C to 35°C

Video capture
640 x 480 pixel

Video format
Uncompressed or JPEG

Lenshead
2.1 F-stop, <1% distortion, fixed focus (25cm to ∞ at 75º FOV)

Field of view
56º to 75º FOV zoom lens

Frame rate
640 x 480 at 60 frames/second
320 x 240 at 120 frames/second

Design and specifications are subject to change without notice.

©2010 Sony Computer Entertainment Europe.
" ▶ " and "PlayStation" are registered trademarks of Sony Computer Entertainment Inc. All rights reserved.

Figure 53. PS3 Eye Camera Datasheet

2. WP 1040 Brushed

Model	WP-1040-BRUSHED WP-1040-BRUSHED-Crawler& Boat *		WP-1060-BRUSHED
Cont. / Burst Current		Forward: 40A / 180A Backward: 20A / 90A	Forward: 60A / 360A Backward: 30A / 180A
Input		2-3S Lipo, 5-9 Cells NiMH	
Cars Applicable		1:10 on-road, off-road Buggy, Truggy, SCT 1:10 Crawler, Tank &Boat	
Motor Limit	2S Lipoor 5-6 cells NiMH	540 or 550 size motor ≥12T or RPM < 30000 @7.2V	540 or 550 size motor ≥ 8T or RPM <45000 @7.2V
	3S Lipo or 7-9 cells NiMH	540 or 550 size motor ≥18T or RPM < 20000 @7.2V	540 or 550 size motor ≥13T or RPM <30000 @7.2V
Resistance		Fwd: 0.002 Ohm, Bwd: 0.004 Ohm	Fwd: 0.0008 Ohm, Bwd: 0.0016 Ohm
Built-in BEC		2A/6V (Linear mode BEC)	3A/6V (Switch mode BEC)
Dimension& Weight		WP-1040-BRUSHED: 46.5*34*28.5, 65g WP-1040-BRUSHED-CRAWLER:46.5*34*28.5, 70g	36*30*18, 40g

Figure 54. ESC WP 1040 Brushed Datasheet

3. E6001

Specifications:

HSP Part Number: 60094A

- Output Torque: 6Kg
- Operating Voltage 4.8 - 6.0
- Water Resistant: Yes
- Shaft splines: 24
- Shaft diameter: 5.85mm
- Included Horns: Yes
- Item No. E6001 Marked on Servo.
- Qty: 1

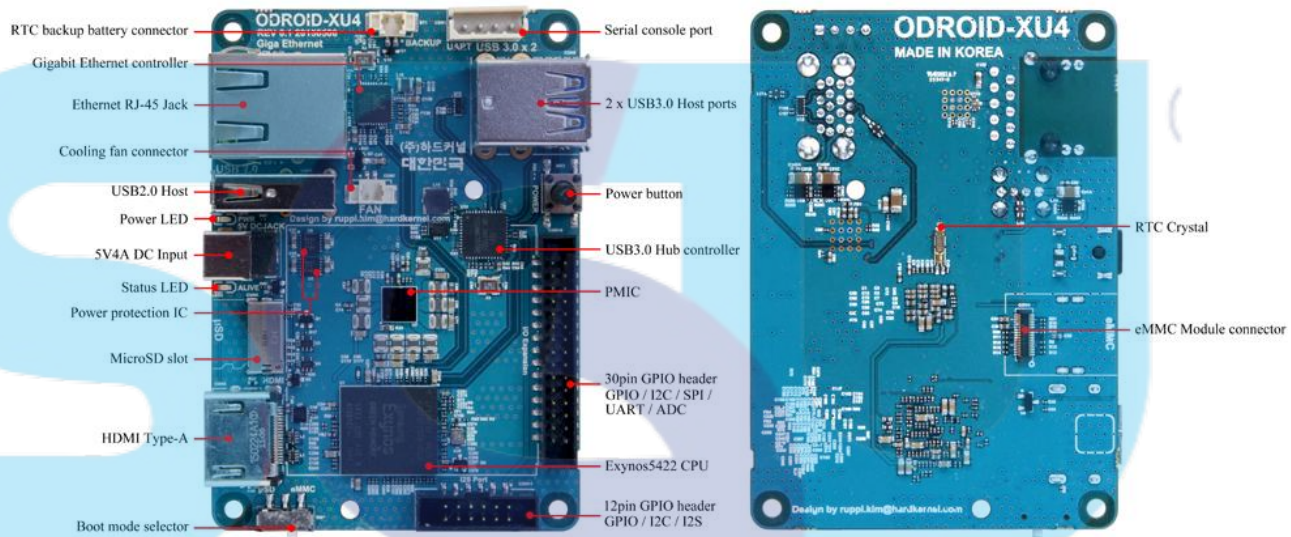Figure 55. Servo E6001 Datasheet

4. Odroid XU-4
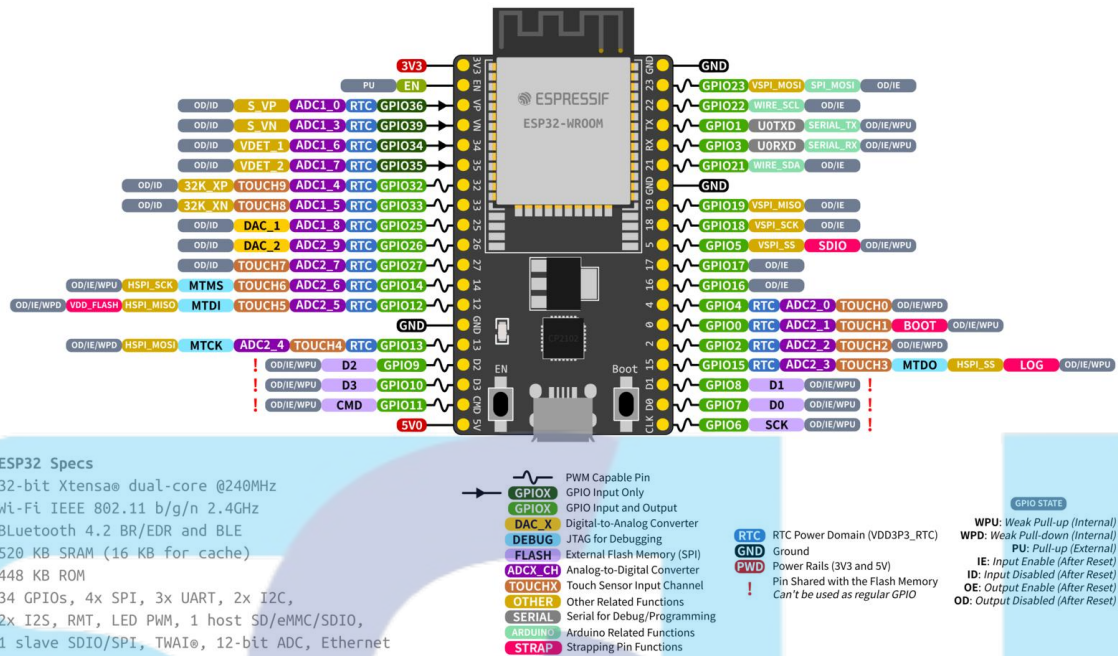

Figure 56. Odroid XU-4 Manual

5. ESP32

ESP32-DevKitC

ESPRESSIF

Figure 57. ESP32 Wroom 32D Pin Layout

APPENDIX B - INSTALLATION AND OPERATING PROCEDURE

1. Lane Detection:

https://github.com/uglymie/lane-line-detection-ROS2-CPP

- source /opt/ros/humble/setup.bash

- mkdir -p ~/ros2_ws/src

- cd /ros2_ws/src/

- git clone https://github.com/uglymie/lane-line-detection-ROS2-CPP.git

- cd /ros2_ws

- colcon build

- source install/setup.bash

- ros2 launch cpp_advanced_lane_lines lane_line_detection_launch.py

2. Micro-ROS:

https://medium.com/@SameerT009/connect-esp32-to-ros2-foxy-5f06e0cc64df

- source /opt/ros/humble/setup.bash

- mkdir microros_ws

- cd microros_ws

- git clone -b humble https://github.com/micro-ROS/micro_ros_setup.git src/micro_ros_setup

- sudo apt update && rosdep update

- rosdep install --from-path src --ignore-src -y

- sudo apt-get install python3-pip

- colcon build

- source install/local_setup.bash

- ros2 run micro_ros_setup create_firmware_ws.sh freertos esp32

- ros2 run micro_ros_setup configure_firmware.sh [PROJECT NAME] -t udp -i [LOCAL MACHINE IP ADDRESS] -p 8888

- ros2 run micro_ros_setup build_firmware.sh menuconfig

- ros2 run micro_ros_setup build_firmware.sh

- ros2 run micro_ros_setup flash_firmware.sh

- ros2 run micro_ros_setup create_agent_ws.sh

- ros2 run micro_ros_setup build_agent.sh

- source install/local_setup.bash

- ros2 run micro_ros_agent micro_ros_agent udp4 --port 8888

APPENDIX C - BILL OF MATERIALS

Table 6. Bill Of Materials

No.	Item	Quantity	Total Price (Rupiah)
1	ESP32 DevKit	1	77.000
2	ESP32 Shield IO	1	85.000
3	7.2V NiMH Battery	1	300.000
4	Bracket Gusset 45-degree	1	5.000
5	Acrylic	3	65.000
6	Sandisk Ultra Curve	1	193.000
7	Data Cable	1	45.000

CURRICULUM VITAE

Hansel Hermawan

Professional Goals

I aim to attain an engaging internship position in the field of manufacturing, on site installation and technical support. I hope to gain internship experience in these fields to improve my skills as a mechatronic student.

Contact Information

Personal Information

Mobile:
0811-1722-911

Email:
hansel.29h@gmail.com

Address:
Kelapa Nias V PB 11 No. 8, Kelapa Gading, Jakarta Utara, DKI Jakarta

Full Name	: Hansel Hermawan
Gender	: Male
Place, Date of Birth	: Jakarta, 29 November 2001
Study Program	: Mechatronic
Faculty	: Engineering & Information Technology

Languages

- Indonesian (native)
- English (conversational)

Abilities

- Microsoft Office (sufficient)
- Fusion 360 (sufficient)
- Solid Works (sufficient)
- ROS 2 (novice)
- C++ (novice)

Hobbies

- Automotive
- Badminton
- Music
- Travelling

Academic History

Swiss German University - Mechatronic

The Prominence Tower, Jalan Jalur Sutera Barat Kav 15, Alam Sutera, Panunggangan Tim., Pinang, Kota Tangerang, Banten 15143, Indonesia

SMAK 5 PENABUR - Science

Jl. Hibrida Raya Blok QA3, Kelapa Gading, Jakarta Utara, DKI Jakarta, Indonesia

Working Experience

Internship in Procurement - 3/2022 to 6/2022

PT. Astra Honda Motor

Internship in Production Planning and Inventory Control - 6/2021 to 7/2021

PT. SpanSet Indonesia

Mechatronic Training - 12/2020

Politeknik Industri ATMI Cikarang